BR2 REACTOR: INTRODUCTION

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The irradiations in the BR2 reactor are in collaboration with or at the request of third parties such as the European Commission, the IAEA, research centres and utilities, reactor vendors or fuel manufacturers. The reactor also contributes significantly to the production of radioisotopes for medical and industrial applications, to neutron silicon doping for the semiconductor industry and to scientific irradiations for universities.

Along the ongoing programmes on fuel and materials development, several new irradiation devices are in use or in design. Amongst others a loop providing enhanced cooling for novel materials testing reactor fuel, a device for high temperature gas cooled fuel as well as a rig for the irradiation of metallurgical samples in a Pb-Bi environment.

A full scale 3-D heterogeneous model of BR2 is available. The model describes the real hyperbolic arrangement of the reactor and includes the detailed 3-D space dependent distribution of the isotopic fuel depletion in the fuel elements. The model is validated on the reactivity measurements of several tens of BR2 operation cycles. The accurate calculations of the axial and radial distributions of the poisoning of the beryllium matrix by ^{3}He, ^{6}Li and ^{3}T are verified on the measured reactivity losses used to predict the reactivity behavior for the coming decades. The model calculates the main functionals in reactor physics like: "conventional thermal" and "equivalent fission" neutron fluxes, number of displacements per atom, fission rate, thermal power characteristics as heat flux and linear power density, neutron/gamma heating, determination of the fission energy deposited in fuel plates/rods, neutron multiplication factor and fuel burn-up.

For each reactor irradiation project, a detailed geometry model of the experimental device and of its neighborhood is developed. Neutron fluxes are predicted within ± 10% in comparison with the dosimetry measurements. Fission rate, heat flux and linear power in advanced material test reactor fuel and mixed-oxide fuel are also predicted within ± 10% in comparison with thermal balance and gamma-spectroscopic methods. The neutron multiplication factor k_{eff} predictions are within ±0.5% compared to reactivity measurements.

Advanced miniaturized on-line monitoring systems are under development amongst others, fast neutron detecting systems and gamma selective self-powered detectors.

The reactor operated again successfully in 2006. The plant reached 96% availability.

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